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Arrow of time Phenomena in Social Science and Sixteen Global Mega Trends of Human Society

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Abstract

Two most important questions in social science are what drives political, economic, and social changes and where the human society is heading. The arrow-of-time coined by British astronomer Eddington refers to our daily experience that time only goes in the forward direction and never in the backward direction. The arrow-of-time phenomena are ubiquitous in both the human society and the natural world. This paper proves that the physics concept of Goldstone boson or hydrodynamic mode is the key to understand the arrow-of-time phenomena in social science, analyze the important drivers of political, economic, and social changes, and answer the question what is the future of the human society. In the condensed matter physics, Goldstone bosons are hydrodynamic modes characterizing the long-lasting fluctuations around the equilibrium state. Hydrodynamic equations, which govern the mathematical description of the behavior hydrodynamic modes, are also the same equations that describe the dynamics of the condensed matter system. In a previous paper, we proposed that the most stable political structure in any nation is an equilibrium state of the political structure, which is characterized by 16 democratic principles. These democratic principles are the Goldstone bosons or hydrodynamic modes of human societies. This paper will examine these low frequency long lasting global mega trends in detail and quantify these political, economic and social movements with the indexing methodology. In statistical physics, there are only a handful of identifiable hydrodynamic modes in any condensed matter system, and it must be also true for the human society. This paper reaches a very surprising conclusion that despite the complexity of human society with billions and billions of changes every day, the only important driving forces of the long-term political, economic, and social changes are these 16 hydrodynamic modes. These democratic principles or Goldstone bosons have dominated the word history since the dawn of the humanity, and these same 16 global mega-trends of the Goldstone bosons will continue to dominate the world political and economic dynamics in the future, and eventually push the human society towards the equilibrium state of the permanent world peace. The hydrodynamic mode approach not only answers the question what drives social changes, but also becomes a powerful new tool to study world history, social science, and futurology (or scientific astrology). This paper further strengthens the argument that social science is a subfield of quantum physics just like the condensed matter physics and chemistry. The arrow-of-time phenomena in the human society and the natural world share the same identical fundamental causes of quantum indeterminacy and human choices.

1. Arrow-of-time Phenomena In Human Society

The question what drives the political, economic, and social changes in the human society is a difficult, elusive, and intractable question. Historians have studied social changes for thousands of years. If there is any consensus about the driving forces of the human society, the consensus among current generation of historians [1-2] seems to be that there are no universal rules for social changes because no single universal history rule have ever been discovered in researches over thousands of years.

This paper takes a different approach to study the social changes. Instead of focusing on the empirical records of thousands of years of human history, we just focus on the arrow-of-time phenomena in the human society for several reasons.

- (1) The arrow-of-time phenomena in the human society are the strongest evidences that the social science and natural science are sharing the same conception framework.

The arrow-of-time coined by British astronomer Arthur Eddington in 1927 refers to our daily experience that time only goes in the forward direction from the past to the future, and never in the backward direction. In the natural world, if adding salts to a cup of pure water, the salts will soon spontaneously dissolve and distribute evenly. The reverse phenomenon under the same condition has never been observed in nature. We have learnt from physics that the many arrow-of-time phenomena are governed by the second law of thermodynamics.

In the human society, the arrow-of-time phenomena are also everywhere. The globalization processes are strikingly similar to the diffusion processes in physics. Since the dawn of humanity, generally speaking, the humanity is building more and more wealth, gaining more and more knowledge, and developing ever more advanced technology. With discovering of physics laws of social science [3-4], we now know that the arrow-of-time phenomena in both the human society and the natural world are governed by the law of equilibrium, which is the generalized second law of thermodynamics.

- (2) In nature, many arrow-of-time phenomena are related with the thermodynamic equilibria. When the systems are pushed away from the thermodynamic equilibria, the systems would spontaneously move back to equilibria.

In the human society, arrow-of-time phenomena are related with the equilibrium political and economic structure. The human society is heading towards a political and economic equilibrium structure. The social arrow-of-time phenomena are the strongest evidences of the existence of the equilibrium political and economic structure for the human society.

- (3) In the condensed matter physics, the spontaneous long-lasting thermo fluctuations near the equilibria are characterized by a few well-defined

Goldstone bosons or hydrodynamic modes [5], which are related to the conservation laws and spontaneous self-organization orders with broken symmetries.

In human society, the spontaneous long-lasting fluctuations near the political equilibrium structure are characterized by 16 democratic principles, which are related to spontaneous self-organization orders. These 16 democratic principles are Goldstone bosons or hydrodynamic modes of the human society.

- (4) In nature, the Goldstone bosons and hydrodynamic modes dominate the macroscopic dynamics of the systems far away from the thermodynamic equilibria.

In the human society, these 16 democratic principles or hydrodynamic modes dominate the long-lasting political, economic, and social changes in the past, present, and future.

Therefore, the question what drives social changes can be answered by studying these 16 democratic principles or hydrodynamic modes. These 16 democratic principles have dominated the world history since the dawn of the humanity, and also will continue to dominate the world changes in the future.

2. Five Physics Laws of Social Science

One of the most fundamental questions in social science is whether exist universal laws of social science, which would unite all knowledge of social science, in the same manner fundamental laws of physics unite all knowledge of natural science.

An important clue that leads to establish laws of social science is the fact that fundamental concepts in social science, such as information, choice, causality, uncertainty, equilibrium, the most stable structure, and the direction of time, are also shared by many fields of natural science including quantum mechanics. In the framework of quantum physics, these concepts can be defined precisely in the language of mathematical physics. Once correctly formulated, the precise descriptions and behavior of these concepts, which becomes five physics laws of social science, are universally applicable to all fields of social and natural science.

Humans and human societies are made of elementary particles, and the behavior of elementary particles is governed by quantum mechanics. Therefore, there should be no surprise to anyone that quantum physics indeed is the theoretical foundation of all fields of social science. Quantum physics is widely believed to be the theory of everything, and everything must include politics and other fields of social science.

The starting point of establishing a scientific foundation for political science is the five physics laws of social science, which have been published elsewhere in a book [3] and an academic paper [4]. For the benefit of readability of this paper, we list five physics laws of social science in the following.

First Law – Law of Indeterminacy

For a closed system, the outcome of any future event in the system is indeterministic. The quantum uncertainty of the future is the fundamental property of nature and cannot be overcome by any means.

Second Law – Law of Prediction

For a closed system, any future event in the system can be and can only be predicted precisely to the extent of a joint probability distribution among all possible outcomes. The joint probability distribution function exists and is uniquely given by quantum mechanics.

Third Law – Law of Choice

Actions, which are constrained by fundamental laws of physics, can be taken between time 0 and time T to modify the joint probability distribution function of time T of a closed system.

Fourth Law – Law of Information

The complete historic information of any closed system cannot be recreated based on today's complete information. At any time step, new information is created and some historic information is lost permanently.

Fifth Law – Law of Equilibrium

For a system under certain constraints, quantum uncertainties in the system will eventually push the system toward equilibrium states.

Five physics laws of social science are closely related with each other. The Law of Indeterminacy is the starting point. The Law of Predict the Future addresses how to predict the future and the causality relationship of an indeterministic system. The Law of Choice addresses how to make a choice and the flexibility and plasticity of an indeterministic system. The Law of Information addresses how information is created and destroyed. The Law of Equilibrium, which is the generalization of the Second Law of Thermodynamics, addresses the direction of time and the equilibrium state of an indeterministic system. These five fundamental laws of physics are profound statements about the nature and human societies.

The explanation and discussion of these five laws can be found in the book [3] and the paper [4]. These laws are fundamental laws of physics, which are applicable to any system including any physical and biological systems, and human societies. Fundamental equation of economics is one application of these physics laws in economics. Five physics laws of social science can be viewed as an extension of quantum physics to macroscopic systems. Many macroscopic phenomena like human free will could only be explained fully by applying quantum physics.

3. Equilibrium Political State

One problem is standing out above all others in social science: how should humanity govern itself? The problem is so important that all wars of humanity in the past, present, and future, are directly related to this problem. An earlier paper [6] has proved that this problem is solvable scientifically applying physics laws of social science, if the problem is formulated in a correct way: what kind of governing political structure of humanity is most stable? Most-stable structure problems appear routinely in the theoretical and experimental condensed matter physics. We show that the humanity governing problem is equivalent to find an equilibrium political structure of a human society, which is a many-body physics problem 100% solvable using the maximum entropy approach widely-used in the condensed matter physics. Quantum politics says that we can create free, fair, just, peaceful, and prosperous human societies. There is certainly no better alternative than the equilibrium political structure, which is defined by a set of 16 democratic principles.

In this section, a short summary of these 16 democratic principles are in the following to show the common physics foundation of these democratic principles.

The principle of maximum freedom says that a free society should give individuals the maximum freedom and liberty because people love freedom, and the maximum freedom will push the economy toward the most efficient state and bring out the maximum creativities in fields of science, technology, and arts according to the law of equilibrium.

The principle of nonviolence and voluntary contract is to resolve conflicts of free wills without violence and to restrain free wills without harming the individual's freedom by asking citizens to be held accountable for voluntary contracts agreed by themselves.

The accountable citizen test is designed to tell whether a citizen can be held fully accountable for his or her voluntary contracts. With the exception of underage children and people with mental disability, nearly all people in a society are accountable citizens.

The principle of political equality says that all accountable citizens must have equal political rights. The principle of political equality means that the equilibrium political state is a symmetric structure with the exchange symmetry.

The principle of the rule of law guarantees that voluntary contracts will be enforced.

The principle of separation of power rise naturally from voluntary contracts. If the power could only come from citizens' voluntary contracts, the political power will not be concentrated in just one or a few people acting as rulers.

The principle of check and balance is needed because we cannot predict precisely how elected officials will behave according to the law of prediction. Strong institutional checks and balances will minimize probabilities that elected officials would abuse their powers.

The principle of optimal decision making is to optimize the collective decision making processes through scientific forecasting, separation of power, balancing interests of all parties involved, carefully choosing the goals and value systems by balancing the science, religion, and political philosophies, and carefully choosing the decision making methods.

The principle of individual rights and fiduciary duty says that fundamental individual rights must be protected from the governments, and collective decision makers have the fiduciary duty to guard interests of other citizens including the minority, children, the unborn future generations, foreigners, animals, plants, other living creatures, and the environment in general. The chronic problems of budget deficits and environmental degradation are examples that political leaders have failed their fiduciary duty.

The principle of no scientific ultimate purpose comes from the fundamental limitation of science and technology. There are many important questions in social science that cannot be 100% answered by science. Science cannot answer what is the ultimate purpose for an individual or for a society. The human beings are fundamentally purposeful animals. While an individual can choose to have an ultimate purpose according to his free wills, a society must not have an ultimate purpose. To establish an ultimate purpose for the society would lead the society on the road to serfdom.

The principle of no scientific value system follows the similar logics. Because the value system is essential for virtually all decision making, quantum politics emphasizes the importance of personal religions and philosophies. The political equilibrium structure emphasizes the diversity of human behavior and the culture pluralism.

The principle of separation of church and state says that the government must not establish the official religion, and no ancient religious teachings should be used as the foundation of the constitutions. The law of information says ancient religious teachings are out dated. The law of prediction says ancient religious teachings have diminished powers to predict future challenges.

The principle of fairness says that in as long as the rules and the process of running a game are fair, the outcome of the game is fundamentally fair. The government should mainly concern the fairness of competition rules not outcome inequality such as the rich and poor gap.

The principle of maximizing wealth says that a human society will always try to maximize the wealth. The increasing wealth is a way to maximize the individual freedom.

The principle of human dignity says that a free society and the government have obligations to help its less fortunate citizens maintain human dignity through the social welfare system.

The principle of limitation of science and technology sets the boundary of science and technology. The decision making processes must go outside the boundary to use personal religions and philosophies. On the other hand, the individual freedom, economic development, and science and technology progresses would push the human knowledge to the limits of science of technology.

The principle of globalization says that the law of equilibrium will push the globalization of the political, economic, and legal systems toward the world permanent peace.

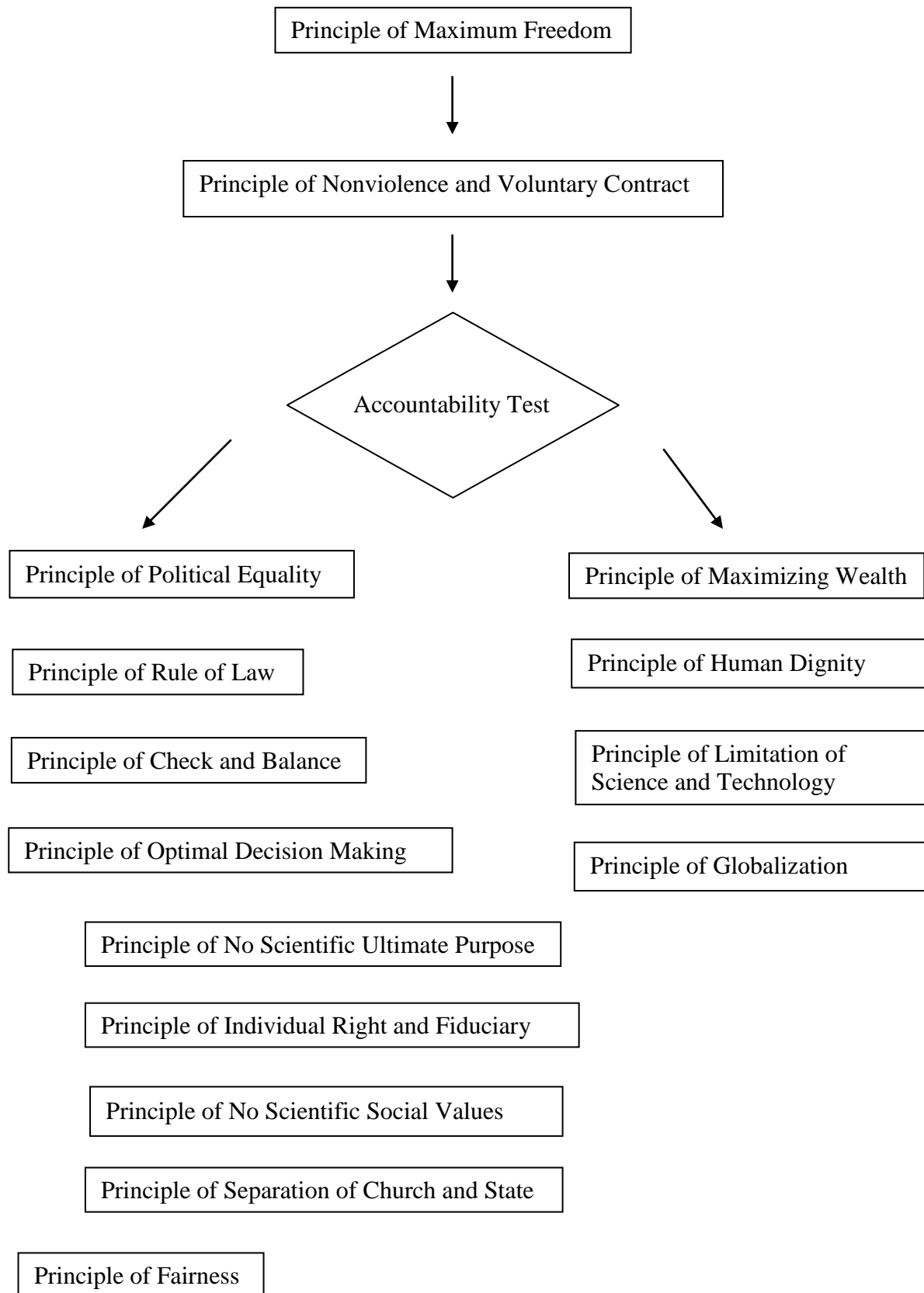
All these 16 principles are based the concept of free will and physics laws of social science. Because people's free wills are quantum uncertainties and the behavior of free will can be only described by quantum mechanics, these sixteen democratic principles are rooted in quantum mechanics, and they are universally applicable to all nations and the world.

These democratic principles can be grouped into three categories:

- (1) Interpersonal relationships. These 10 principles reflect the interpersonal relationships in the equilibrium state include principle of nonviolence and voluntary contract, principle of political equality, principle of the rule of law, principle of separation of power, principle of check and balance, principle of optimal decision making, principle of fiduciary duty, principle of fairness, principle of human dignity, and principle of globalization.
- (2) People and environment relationship. These 3 principles reflect the principle of maximizing wealth, principle of limitation of science and technology, and principle of fiduciary duty.
- (3) People's individual freedom, private space, philosophy, and spirituality. These 5 principles are the principle of maximum freedom, principle of individual rights, principle of no scientific ultimate purpose, principle of no scientific value system, and principle of separation of church and state.

It is easy to see that the political equilibrium state has very refined interpersonal relationships. That is not surprising because politics is all about resolving conflicts of free wills.

These 16 democratic principles are also summarized in a figure in the next page for the easy reference.



4 Long-Term Changes in Human Society

There are millions and billions changes in the human society every day. However, many-body physics teaches us [5] that most these changes are transitory, short-term, and insignificant, and we should mainly focus on those low frequency long lasting changes in any many-body systems. There are only a handful truly low frequency long-term changes that dominates the dynamics of the human society.

In this section, we will review the hydrodynamic approach in the many-body problems in the condensed matter physics. We show that the same approach should be used to study changes of human society. The 16 democratic principles of the political equilibrium structure are the Goldstone Bosons that dominate the long-term dynamics of the past, present, and future of the human society.

4.1 Goldstone Boson in Condensed Matter Physics

Consider a cup of water in the room temperature. At the molecular level, there are trillions of trillions changes every second. However, statistical physics teaches us that most these changes are transitory, short-term, and insignificant at the macroscopic level.

If the cup of water is in the thermodynamic equilibrium, the long-lasting microscopic thermo fluctuations are only a handful of significant changes called Goldstone Bosons or hydrodynamic modes. The Goldstone Bosons and hydrodynamic modes are physics terminologies referring the same things, and will be used interchangeably through this paper.

In a simple fluid like water, there are only 5 hydrodynamics modes [5] associated with the 5 conserved variables: the conservation of energy, mass, and the 3 components of the momentum vector. The conservation of momentum and the Newton second law of motion lead to the famous Navier-Stokes Equation, which is widely used in the fluid dynamics.

While hydrodynamic modes are identified with the thermo fluctuations at or near the thermodynamic equilibria, the methodology and equations of the conservation laws like Navier-Stokes Equation are applicable with systems far away from the thermodynamic equilibria. In essence, the long-lasting macroscopic changes of the simple fluid are also dominated by the hydrodynamic modes or Goldstone bosons.

4.2 Driving Forces of Social Changes

In a simple liquid like a cup of water, the thermodynamic equilibrium, the second laws of thermodynamics, hydrodynamic modes, and hydrodynamic equations are well understood [5]. In this paper, we can apply the same approach to study changes of the human society.

The human society can be viewed as a many-body system with conflicting free wills. The equilibrium state is a global equilibrium political and economic structure of the permanent world peace characterized by 16 democratic principles.

The indeterministic nature of human free wills will cause the equilibrium political and economic structure to fluctuate. These long-lasting fluctuations are 16 hydrodynamic modes associated with these 16 democratic principles.

Although the human society has not been close to the global equilibrium, these 16 hydrodynamic modes are the driving forces of social changes. Therefore, despite the complexity of human society with billions and billions of changes every day, the only important driving forces of the long-term political, economic, and social changes are these 16 hydrodynamic modes. These 16 democratic principles or Goldstone bosons have dominated the world history since the dawn of the humanity, and these same 16 classes of global mega-trends of the Goldstone bosons will continue to dominate the world political and economic dynamics in the future, and eventually push the human society towards the equilibrium state of the permanent world peace.

4.3 Examine Global Mega Trends of Social Changes

We will examine each of these global mega trends in details from different angles: the political movements in past, present, and future; the boundaries of these 16 democratic principles; the use of index methodology to quantify these global mega trends.

4.3.1 Political Movements in Human Society

Political movements are familiar social phenomena in our everyday life. A political movement is a group of people with shared interests to promote a political, economic, or social goal. There are many political movements at the local, regional, national, or international levels at any moment.

Most of these political movements are transitory, short-term, and insignificant. There are only a handful of truly long-lasting political movements associated with 16 democratic principles that dominates the dynamics of the human society.

In essence, we can classify all political movements into two distinct groups: the permanent political movements associated with 16 democratic principles that dominate the dynamics of the human society, and other non- permanent political movements.

4.3.2 Democratic and Undemocratic Societies

In many undemocratic societies, many of these 16 democratic principles are not widely accepted by the population and the government. If a democratic principle has not been realized in a country, the permanent political movement associated with this democratic principle will show up as a political movement fighting for the realization of this democratic principle.

For example, people in many countries do not have the freedom of speech. In those countries, there will always be people who will fight for the realization of the freedom of speech.

In many democratic societies, some of these 16 democratic principles are widely accepted by the population. However, most democratic societies are far from the political equilibrium state including the US. If a democratic principle has been widely accepted by the population in a country, the permanent political movement associated with this democratic principle will show up as the fighting for the applicable boundary of this

democratic principle. If a democratic principle has not been widely accepted, there are political movements that would promote the democratic principle.

For an example, the principle of freedom of speech has been universally accepted as the cornerstone of the American society, and the right of free speech has been codified in the first amendment of the constitution. Yet in US, there are constant struggles to define the exact boundary of the freedom of speech. For example, what should be the boundary regarding the display of pornographic images. Because the freedom of speech is associated the principle of maximum freedom, this paper predicts that the political movements of defining the exact boundary of the freedom of speech will last forever.

From the example of the freedom of speech, we show that there is a permanent political movement to promote the freedom of speech in all human societies whether they are democratic or undemocratic societies. In essence, the freedom of speech reflects something fundamental of the human nature.

4.3.3 Universal Dynamics of World History

The perennial question in social science is whether history is a science. Since Toynbee's masterpiece [2] *A Study of History*, most historians have abandoned the fruitless search for the universal dynamics in different civilizations [1]. However, there are universal dynamics in the world history [7].

First of all, the world history is governed by universal laws of physics known as physics laws of social science. The law of information says that information is constantly created and destroyed. The important logical consequence for studying the world history is the human history uncertainty principle: there are fundamental uncertainties about the world history that cannot be overcome by any means. In essence, the world history is about historic facts and also about the fundamental uncertainties about those facts.

Second, the causality in the world history are indeterministic and can be described by a general mathematical equation we called the fundamental equation of social science [8-9]. From the physics point of view, quantitatively, the human history is about running the fundamental equation of social science backward in time in order to build coherent descriptions of the historic events based on today's the knowledge and artifacts. Because of the human history uncertainty principle, there are always uncertainties in our understandings. Just like any other fields of science, the study history is to help our understand causalities in the human society. Therefore, history is a science.

Third, the hydrodynamic approach to study the collective behavior shows that there are only 16 global mega trends that dominate the world history. While some of these trends like technology advances are well-known to all historians, others trends like trends towards diversity of cultures or permanent world peace are much less obvious.

In the long run, many historic details like changing from one undemocratic government to another undemocratic government might not be very consequential. Therefore, those historic facts become less important.

4.3.4 Futurology and Scientific Astrology

Given the fact that most university in the world offers history classes, and most students are required to learn history from kindergarten to the graduation from the high

school, history is considered a very important subject in the human knowledge. However, for most students and most people, knowing the future would be far more important and useful than knowing the history. For example, knowing how people are going to live their lives in 20 years would be far more valuable than knowing how people lived their lives two thousand years ago. For example, students can prepare and sharpen their job skills for the future.

Yet, very strangely, almost no university teaches the knowledge about the future. There is no official name for the subject. In the tradition, the subject about the future is called astrology. Some people prefer to call the subject futurology or the scientific astrology.

In the framework of PLSS, the future is predictable in the language of probabilities. In the fluid mechanics, the Navier-Stokes Equation and hydrodynamic equations are used to predict the future of the fluid dynamics. In the human society, the 16 democratic principles provide a new tool to predict the long-term future.

4.3.5 Permanent World Peace Index

Since the political movement of promoting the freedom of speech is a permanent feature of the human society, we can quantify the degree of the freedom of speech on the individual level first and then create an aggregated index to measure the degree of the freedom of speech on the national and global level.

The index can be viewed historically to show the trend of social changes. Although the law of equilibrium says that the general trend of these indexes should rise. However, because of the indeterminacy of the human being, the index could fall in the short term.

In quantum politics, all political concepts are physics concepts. There are precisely defined and ready to be quantified. For example, the concept of freedom is defined as the freedom to choose and not something else. Choice itself is a quantum phenomenon. The freedom of speech can be observed and measured on the individual level just like any other physics variables.

There will be many sub-indexes associated with each of the democratic principle. For example, many indexes are needed to describe the different freedom: freedom to speech, freedom to religion, freedom to assemble, and etc.

The indexes of 16 democratic principles in each country can be further aggregated into the permanent peace national index for each country. This national index measures the distance a country from the permanent peace state within that nation. For example, we have applying the 16 democratic principles to examine carefully the flaws of the US constitution [10]. While the US constitution is very well designed, there are many fundamental designs like the failure to protection of financial interests of the future generations.

The permanent peace index of every nation can be further aggregated into one world permanent peace index. Therefore, the permanent world peace index has three dimensions: historically, geographically by each nation, and each of 16 democratic principles.

5. Sixteen Global Mega Trends Shaping Human Society

In this section, we will discuss each of the 16 global mega trends in five aspects outlined in previous sections: political movements in undemocratic societies, political movements in democratic societies, trends in the world history, trends in the future, and quantification with the index methodology. We will look at political movements, the historic perspective and future trends, and the indexes to track the global trends.

5.1 Global Trends Based on Principle of Maximum Freedom

The global trend towards a world with more freedom of choice enjoyed by all global residences is unmistakable. Yet the world is very uneven in terms of achieving the degree of freedom for their citizens by different countries. In countries like US, citizens enjoy very high degree of freedom; in countries like North Korea, citizens enjoy low degree of freedom.

5.1.1 Worldwide Freedom Movements in Undemocratic Nations

Although the United Nations Universal Declaration of Human Rights have codified the freedom of expression, press, association and assembly, religion, and movement since 1948, many global citizens do not have these basic rights.

In all undemocratic countries, the freedom movements are always alive. Since the most significant threat toward the stability of the undemocratic governments is always the freedom movements, the undemocratic governments would do almost anything to stop the freedom movements. However, the freedom movements always bounce back spontaneously. Pursuing the maximum freedom of choice is one of most important human natures.

5.1.2 Adjusting Boundaries of Individual Freedom

In democratic countries, the individual freedom is granted by the constitutions. The freedom political movements have different appearances. Although individual freedom is guaranteed by laws, the boundaries of individual freedom are subjected to constant pushing back and forth. These constant adjustments correspond to the thermo fluctuations in thermodynamic equilibria in the condensed matter physics.

In democratic countries, the individual freedom is not absolute. For example, although the freedom of speech is one of most cherished freedom, one cannot use the freedom of speech to advertise the pornographic businesses near elementary schools. In US, the Supreme Court often has to decide where the exact boundaries of individual freedom are.

In US, laws generally forbid the prostitution and the use of marijuana. There are freedom political movements to legalize the prostitution and the use of marijuana.

Therefore, the freedom political movements are alive and well even in mature democratic countries like the US.

5.1.3 Tyranny of Survival

Since we define the concept of freedom as having opportunities to choose in quantum politics, the restriction to the individual freedom to choose comes from the conflicting of free wills and the pressure of the individual survival. We call the pressure of survival as the tyranny survival.

For people lived in the primitive society, the pressure of the individual survival were intense. Generally, besides of the pressure to find sufficient food, the threads of violent crimes and wars were never very far away [7]. Under the tyranny of survival, people, who barely survived, did not have much freedom to choose.

For people lived in the modern world, the basic survival needs are no longer a problem. There are rules of law to guarantee the personal safety. However, the maintaining the average level of the living standard of a society is a still daily struggle for most people. Thus the tyranny of survival is still with us with a different appearance in a modern society.

5.1.4 Global Trend toward Individual Freedom

Historically the global trend toward individual freedom is unmistakable since the dawn of the humanity.

Before the agriculture revolution, while individuals had lots of freedom when they were alone, healthy, and well-fed, the individual freedom was greatly restricted by the tyranny of survival and lack of laws and rules.

From the agriculture revolution to the creation of the US Constitution in 1787 and the Bill of Rights in 1791, there were many progresses made to achieve personal liberty. During that period, the individual freedom was a matter of the policies of undemocratic governments. If the rulers were excessively oppressive, people did not have much of individual freedom; if the rulers were open and tolerant, people could enjoy a great deal of freedom. Also during that period, the slavery was gradually out of favor. The creation of the US Constitution in 1787 and the Bill of Rights in 1791 were landmark achievements in the human history of freedom. For the first time, the individual rights were guaranteed by the Constitution and even the most powerful government could not take it away from people.

For the next two hundreds plus years, following the US example, the successes of the freedom movements in many countries have established individual freedom permanently protected by laws.

Today, while individual freedoms are taken granted for many democratic countries, the speeches, newspapers, and internet articles are constantly monitored and censored in many other countries.

Going forward, the global trend towards individual freedom will certainly continue. In the democratic countries, the boundaries of individual freedom will be constantly adjusted. Those undemocratic governments are meta-stable. The freedom political movements will constantly threaten the stability of those undemocratic governments.

5.1.4 Worldwide Freedom Index

In quantum politics, the freedom is a physics concept and defined as free wills having opportunities to choose. The degree of individual freedom in a society can be quantified. While the accurate and detailed methodology is beyond the scope of this paper, we will scratch an outline to how to measure the individual freedom in different societies.

The measurement has two parts. The first part is the individual freedoms that members of society enjoyed. The individual freedoms have many components: freedom of expression, press, association and assembly, religion, movement, and several others. In quantum politics, it should emphasize that we do not regard the negative freedom like freedom from political persecution as individual freedom.

The second part is the measurement of the government legal framework and daily practices to safeguard the individual freedom including minimization of the complexity of government bureaucratic systems.

In countries like US, the future threats of individual freedom are the government laws and regulations. For example, if individuals choose to open new businesses or publish new books, the governments should keep the bureaucratic paper work at the absolute minimum. Bureaucratic complexity is another form of tyranny restricting individual choices. Unfortunately, in US, the bureaucratic complexity has grown very rapidly in recent decades.

5.2 Global Trends Based on Principle of Nonviolence and Voluntary Contract

Today the principle of nonviolence and voluntary constitution is not nearly as widely accepted in the world as the principle of maximum freedom. The central issue of any human society is how to resolve the conflicts of free wills. The principle of nonviolence and voluntary contract says that the conflicts of free wills should be resolved always through nonviolence negotiations, voluntary contracts, and the rule of laws.

5.2.1 Global Trend toward World Peace

The global trend toward the world peace and nonviolence resolution has slowly gained some tractions and momentum only in recent decades. With the World War I and World War II, the first half of the 20th century was regarded as the most violent period in the entire human history. However, the global trend toward the world peace and nonviolence resolution is still unmistakable.

To use violence to resolve the conflicts of free wills is nature for non-human animals. One of the greatest human inventions is to learn to resolve the conflicts of free wills through nonviolence negotiations, voluntary contracts, and the rule of laws. While domestic and international peace could be achieved temporary through many ways, the permanent domestic and international peace could only be achieved through the carefully designed constitutional democracy.

Before the agriculture revolution, people tended to live closely with their close relatives in order to achieve personal safety. Because there were no laws to forbid violence by the strangers, that was an extremely dangerous world [7].

After the agriculture revolution, people learnt to live together with strangers relatively peacefully in villages and cities by creating powerful governments. One of key functions of governments was to resolve the conflicts of free wills, and to make laws and rules for people to follow. People have fundamental physiological limitations to know no more than a few hundreds of peoples reasonably well. When the villages and cities had thousands of people to deal with, and many of them were dangerous strangers. People were forced to invent the governing political structure.

While the conflicts between states could be resolved through nonviolence negotiations and voluntary treaties, it was very hard to enforce the treaties without a centralized powerful world government. Wars between nations have been the main topic of the world history up to now.

Within the national borders, several countries gradually came to invent political systems to resolve all conflicts through elections, nonviolence negotiations, voluntary contracts, and the rule of laws.

In UK, the last English Civil War ended in 1651. The end of English Civil War and the Glorious Revolution in 1688 finally established that the English monarch cannot rule without the Parliament's consent. Since 1689, the British government has become a political system of the constitutional monarchy, which has ruled England, and later the United Kingdom, without any major interruption.

In the US, even after the creation of the US Constitution in 1787, there were American Indian Wars and American Civil War. In many ways, these were major failures of the US Constitution. However, overall, the American society has enjoyed 227 years of stable continuous governments and relatively internal peace through many challenges including two world wars and the Great Depression.

Over last 100 years, the mature democratic countries like UK, US, Canada, Australia, and many European countries have almost achieved the permanent peace within their national borders. In these countries, the principle of nonviolence and voluntary contracts has been finally universally accepted by the government and population. They have enacted laws to prevent civil wars, military coups, and other large scale violence. They have learnt to transfer the political power peacefully.

Today, countries are divided into three distinct groups. The first group of countries has nearly achieved the permanent national peace within their national borders. We emphasize the word nearly here because the true permanent national peace requires no fundamental design flaws of the constitutions. The US constitution has many fundamental design flaws [10]. The second group of countries has constitutional democracies, but the principle of nonviolence and the rule of law have not been firmly established. The third group of countries is undemocratic, and the habit of violence is going away very slowly. The undemocratic governments are using potential violence as tool to maintain the stability and the population does not believe the rule of laws.

Looking forward, there is no doubt that all countries are heading toward the permanent national peace within their national borders. In the end of the day, people prefer peace much more than violence.

Internationally, after the extreme violence of the World War I and II, the violence level has been reduced dramatically in last 70 years. However, that could be the calm before a bigger storm. During last 70 years, most countries have dramatically expanded their weapon system capabilities. Many countries have developed some capabilities of the

nuclear, biological, chemical, and robotic weapons of massive destructions. Most importantly, today's world order is ultimately based on the military strength of the major world powers.

There are also many positive developments internationally. Despite all the flaws, the United Nations has been working as the world government since the World War II. The cooperation between the mature democratic countries is very encouraging. There is virtually no armed conflict between the mature democratic countries. After thousands of years of wars, European countries finally work together peacefully to form the European Unions.

Looking forward, the permanent world peace is still a remote dream. There is no world permanent peace until there is a carefully designed democratic world governments.

5.2.2 Sharp's Nonviolence Resistance Theory

Political scientist Gene Sharp has developed an elegant nonviolent resistance theory [11] which fits nicely in the framework of quantum politics. Sharp's has two key insights. One is that the political power of any state derives from obedient subjects of the state. If the subjects do not obey the ruler, the ruler does not have power. The subjects can overthrow an undemocratic government simply by refusing orders from the ruler. The other key insight is that there are many democratic principles and many different nonviolence movements [12] to promote these democratic principles. The undemocratic rulers always need to maintain an undemocratic institutional framework to safeguard the obedience of subjects. This undemocratic institution framework will weaken under constant attacks of different nonviolent democratic movements. These nonviolent resistance movements based on democratic principles rise spontaneously because the hydrodynamic modes of the equilibrium political structures, and in the long run these nonviolent resistance movements based on democratic principles are far more powerful than the undemocratic institution frameworks.

Thus, Sharp's nonviolence resistance theory is an integral part of quantum politics. Many of Sharp's nonviolence resistance movements are indeed hydrodynamic modes of the equilibrium political structures, simply because some of most inspiring words in the world widely used in political movements are freedom, nonviolence, democracy, equality, accountability, the rule of law, justice, fairness, individual rights, human dignity, and the world peace.

5.2.3 Movements of Gun Control

The principle of nonviolence emphasizes the peace resolutions for all conflicts among free wills including conflicts between nations, domestic political conflicts, and personal conflicts. While the idiosyncratic violent crime would never be eliminated because people have free wills, the systematic violent crime should be minimized.

In US, the epidemic gun violence is largely due to a fundamental design flaw in the US constitution. The US homicide rate in 2012 is 4.7 per 100,000 while the rate is 0.3 in Japan and the rates in many European countries are about 1 per 100,000, according to a report [13] by the United Nations Office on Drugs and Crime. There are active political movements of gun control.

In some democratic countries like Brazil, the homicide rate in 2012 is 25.2 per 100,000, which is 80 times more violent than the Japan. People in Japan and Brazil are fundamentally the same, and the different crime rates are mainly due to their legal systems, legal practices, and cultural acceptance of the principle of nonviolence and the principle of the rule of law.

5.2.4 Index of Global Violent Death and Crime

The index of global violent death and crime is designed to measure the degree of nonviolence resolutions of conflicting free wills.

The measurement also has three parts. The first part is the measurement of violent deaths and crimes due to wars, political conflicts, and violent crimes. The second part is the measurement of the government legal framework and daily practices to safeguard the individual safety. The third part is the measurement of the international legal framework and daily practices to prevent wars and international violent crimes.

5.3 Global Trends Based on Principle of Political Equality

The accountability test is designed to tell whether a citizen can be held fully accountable for his or her choices and voluntary contracts. With the exception of underage children and people with mental disability, nearly all people in a human society are accountable citizens. The principle of political equality says that all accountable citizens must have equal political rights domestically and internationally. In the context of the principle of political equality, the concept of equality is limited to the equality of political rights.

While the world has made big progresses to achieve the political equality for the global citizens in last 100 years, much works remain to be done.

5.3.1 Global Trend toward Political Equality

The political equality is a relative new political concept in the world history. Theoretically, the word equality means many different things to many people. In quantum politics, the political equilibrium state implies only the political equality but not economic equality or social status equality. The political equality is guaranteed by the laws while the economic inequality and social inequality are results of personal choices and the future indeterminacy. The communism movements, which aim to achieve the economic equality instead of political equality, claimed about 100 million victims around the world in the 20th century [14]. The confusion between economic equality and political equality remains in the political science and the real world politics up to now.

Generally people are not equal in terms of political, economic, and social standing in the world. In the world history, it has been very difficult for people in power to grant selflessly the equal political rights to all accountable citizens in an unequal world.

Before the agriculture revolution, because there was no law, the political equality has somewhat different meanings. The equal political power for adult members could be an important local issue in the tribal societies.

After the agriculture revolution, the most governments in the world history were not democratic elected. Fundamentally there was no political equality for citizens. The noticeable exception was the Athenian democracy developed in the 5th BC. In the city-state of Athens, only adult and male citizens could vote while women, slaves, freed slaves, and foreigners were not allowed to vote.

In most undemocratic societies, people were classified into different social classes with different political rights while the ruling class was generally a minority. The different levels of political equality were used as a political tool to enhance the political stability of the undemocratic societies.

After the democratic societies emerged, the political equality was limited until recent decades. Take the US as an example. The 15th Amendment was ratified in 1870 which states that the “right of citizens of the United States to vote shall not be denied or abridged by the United States or any state on account of race, color, or previous condition of servitude.” The woman’s right to vote was granted by the 19th Amendment on August 20, 1920. The 15th Amendment was not fully implemented until passing the Voting Rights Act of 1965, which allows African American especially in the southern states to register to vote. Even today, there are several fundamental design flaws [10] in the current US constitution which denies the equal representation of the US citizens. For example, as of the Census data on April 1, 2010, the population of District of Columbia is 601,723 and growing at a rapid pace. The population of Vermont is 625,741, and that of Wyoming is 563,626. All these three places have 3 electors for the presidential election. However, Vermont and Wyoming both have 1 seat in the US House and 2 seats in the Senate while Washington DC has ZERO representation in the US House or the Senate.

Over last 100 years or so, the political equality gradually gained the worldwide acceptance. The United Nations General Assembly adopted in 1954 the Convention on the Political Rights of Women, which grants women the equal rights to vote, hold offices, and access public services. Today most countries in the world granted the equal political rights to women with the noticeable exception of Saudi Arabia.

In undemocratic societies today, the political equality cannot be implemented without the rights to vote. In democratic societies, there are political movements pushing for the equal representation and against discriminations based on races, gender, ancestries, and other social classifications.

Looking forward, the fights for the political equality would certainly continue. It is no doubt that the political equality will be implemented eventually in all countries because the political equality is the exchange symmetry of a political system. Without the exchange symmetry, the political system will be metastable at best. For the same reason, eventually the equal representation in the world politics will also be implemented. The design of United Nations is deeply flawed without the political equality for global accountable citizens.

5.3.2 Global Index of Political Equality

The global index is designed to measure the political equality and the level of discriminations based gender, races, ethnic, religion, region, and other social classifications. The measurement has three parts.

The first part is to measure the political equality and the level of discriminations for each country. The second part is to measure the legal framework and daily practices to safeguard the political equality for all accountable citizens for each country. The third part is to measure the political equality internationally.

5.4 Global Trends Based on Principle of the Rule of Law

The principle of the rule of law is universally regarded as the most important cornerstone of many democratic societies. However, to achieve the full potential of the rule of law has been hard for many countries.

5.4.1 Global Trend toward the Rule of Law

The use of laws to manage human affairs was an integral part of developing the civilizations. While the democratic societies are characterized by the rule of law, the undemocratic societies are often characterized by the rule by law as rulers use laws as a political tool to rule the subjects.

Before the agriculture revolution, human beings lived in tribes and ruled by tribal leaders. The tribal affairs were simple enough that there was no formal law needed.

After the agriculture revolution, as the population of cities grew, the needs to coordinate the behavior of city residents produced the first known law by a Sumerian ruler called Ur-Nammu in today's southern Iraq in about 2200BC.

Laws have been very effective tools to rule big nations because it set standards to punish bad behavior and encourage good one. By aligning the diverse incentives of the subjects with the rulers, countries would move the directions desired by the rulers. One of critical turning point of ancient Chinese civilization was associated with the enacting laws to develop the economy and militarize the entire populations in the Kingdom of Qin in 356 BC. Before the reformer Shang Yang joined the country, the Kingdom of Qin was poor and weak in military. With the strong backing of King of Qin, Shang Yang put the well-developed legalist political philosophy into practice. He believed in the rule by law, meritocracy, right incentives, standardization, free markets, economic developments, and military powers. He did not believe in Confucious teachings, individual rights, nonviolence, and harmony relationships. He privatized the land rights and encouraged free trades. He made laws to strip the land rights from the nobles and rewarded the lands to soldiers according their military achievements. He also enacted laws to punish the bad farmers by turning them into slaves to work for the good farmers. He welcomed immigrants and encouraged the population growth. The results were nothing short of astonishing. Within two decade of Shang Yang Reform, the Kingdom of Qin became the most powerful nation in the warring China. After his death, Shang Yang's legal and political systems were preserved and enabled the Kingdom of Qin to unify the China for the first time in the history in 221 BC, which was 117 years later after his death.

If used effectively, laws could be powerful tools for undemocratic rulers. However, the rulers were always above the laws. In a long and difficult path toward the principle of the rule of law, the Magna Carta of 1215 A.D. was an agreement wildly recognized as a historic milestone which required the free will of the king of England to be bound by law. Fed up by abuses of King John in 1215 A.D., with help of the Pope,

rebel English nobles asked King John to sign the agreement (Magna Carta) to recognize rights for both noble and ordinary Englishmen. No one, including the king, is above the law. The US constitution in 1787 went one step further because not only no one is above the law but every voter has the same equal political power in US.

Today in undemocratic societies, the rule of law is possible and rare. While Hong Kong people do not have the full democracy, they do have the rule of law. Most undemocratic societies have the rule by law. The undemocratic rulers use laws as tools to rule subjects.

Today although many democratic societies have the rule of law in their constitutions, the implementations are far from satisfactory. For example, there are epidemic corruptions in India. The crime rates are very high in Brazil. The gang violence in Mexico is out of control.

Looking forwards, there is no doubt that the rule of law will be the future of the humanity because the rule of law has been gained the widely acceptance in the world. Take the US as an example. Few people in the US would like to go back the days of unpredictable and foolish kings, queens, or emperors. However, internationally, to apply the rule of law to settle international conflicts is still a remote dream. While there are international laws and treaties, few major conflicts have been settled through the international laws. The main road block to the global rule of law is missing a credible democratic world government.

5.4.2 Index of the Rule of Law

The global index of the rule of law is designed to measure the level of acceptance of the rule of law in a society. The measurement has three parts.

The first part is to measure the overall crime rates and people's acceptance of the rule of law for each country. The second part is to measure the government legal framework and daily practices to promote the rule of law including the degree of corruptions and abuse of power by government officials for each country. The third part is to measure the degree of the rule of law internationally.

5.5 Global Trends Based on Principle of Separation of Power

In democratic societies, the government powers are rooted in the citizens with political equality. Thus the individuals are power centers at the most basic level. On top of that, there are many power centers responsible for federal, state, and local level governments. At the federal level, the federal government is broadly divided into several branches. The separation of power is a natural consequence of the political equality and self-rule.

5.5.1 Global Trend toward Separation of Power

The global trend of separation of power is closely related with the trend of constitutional democracy. We would not repeat here.

In the undemocratic societies, the concentration of political power is normal. Usually the political powers are concentrated on the rulers of the undemocratic societies.

The rulers would delegate some of his powers with the ruling class. Historically, the power balance between the central governments and the regional governments has been constant sources of political instabilities of undemocratic societies. If the central government was too powerful, the local needs were usually ignored. The resentment of the local population could lead to political instabilities. Also if the rulers of powerful central governments were wise and effective, the whole countries could benefit. Otherwise, the whole countries would suffer. If the regional governments were too powerful, the orders from the central governments could be ignored. Or even worse, the official of the regional governments could rebel and try to replace the weak central governments. During the 2,000 years' rule of the ancient Chinese Empire, the power struggles between the central and regional governments dominated the Chinese political dynamics. Strangely, no one had ever figured out a long lasting solution how to separate powers properly in more than 2,000 years. The right solution seems to be democratic governments.

Looking forwards, the global trend toward the constitutional democracy is unmistakable. In democratic governments, the central governments and regional governments become equal partners with their own well-defined political powers and legal responsibilities.

Internationally, the United Nations has been so weak that it causes the powerful nations to compete and dominate the world politics. In the long run, the democratic world government should be properly empowered to resolve the international conflicts and maintain the world peace, while the national governments would be responsible to manage their own local politics.

5.5.2 Index of Concentration of Political Power

The global index of concentration of power is designed to measure the level of power concentration in a society. The measurement has three parts.

The first part is to measure the power concentration for each country. The second part is to measure the government legal framework and daily practices to promote the separation of power in each country. The third part is to measure the degree of the power separation internationally.

5.6 Global Trends Based on Principle of Check and Balance

In democratic societies, the principle of separation of power is also closely related with the principle of checks and balances. The checks and balance

5.6.1 Global Trend toward Check and Balance

The global trend of check and balance is closely related with the trend of constitutional democracy. We would not repeat here.

In undemocratic societies, the powers of rulers are usually unchecked. The rulers are law makers, judges, and presidents at the same time. Historically the unlimited powers of rulers not only lead to corruptions but also major sources of political instabilities. The transfer of such unlimited powers often causes bloody power struggles

or even civil wars. At the local level, because the local political powers come from the orders of the central governments, the local population and local media could provide only weak checks.

Looking forwards, the global trend toward check and balance and constitutional democracy is clear. The check and balance of three equal branches of the federal government have worked very well in the US in last 227 years. It set an excellent example for the rest of the world.

5.6.2 Index of Check and Balance

This global index is designed to measure the level of check and balance of different levels of government powers in a society. One important aspect of power balance is the media coverage. Media in the US is so powerful that it is often called the fourth branch of the government. The measurement has three parts.

The first part is to measure the check and balance of powers at the national government for each country. The second part is to measure the check and balance of powers at the local governments for each country. The third part is to measure the check and balance of powers of international organizations.

5.7 Global Trends Based on Principle of Optimal Decision Making

Because the flexibility offered by the democratic societies, it is possible to optimize the decision making process. The properly separation of power will be one of the methods.

5.7.1 Global Trend toward Optimal Decision Making

How to optimize the political decision making processes has been a constant challenge of all government in the world history. Establishing the physics laws of social science brings some new insights to this ancient problem.

While the needs for the optimal decision making in undemocratic societies are the same as in democratic societies, it is much hard to optimize the decision making in undemocratic societies for several reasons:

- (1) Undemocratic societies have the advantage of making important decisions at lightning speeds because of the high concentration of powers on a few people. However, the fast decision making has many problems. If the rulers were great leaders like Alexander the Great, Julius Caesar, or Napoleon, the countries could benefit. If the rulers were bad leaders like Stalin or Hitler, the countries would suffer badly.

Important decisions in democratic societies often take long and careful debates and deliberations. The chances of making extremely bad decisions are minimized. The framers of the US constitution set many veto points to slow the decision making processes on purpose.

- (2) The scientific decision making processes need the accurate information. The transparency of the democratic societies helps keep the information accurate.
- (3) The decision making processes always involve the value systems of the decision makers. Because there are only few people are involved in the key decision making processes, the views and interests of people are often ignored. For example, the environmental degradation in China in recent decades has been very alarming. If the views and interests of people were heard, many policies would take the environment costs into consideration.
- (4) In the democratic societies, because local officials are elected by local people, local officials have to make decisions best for the local populations. In undemocratic societies, because local officials are chosen by the central governments, the interests of the central governments are always above the interest local people.
- (5) Only the democratic society the flexibility to offer the political decisions to be made through a broad range of methods: referendum, the voluntary process of the free markets, a group of representatives, a group of experts, or a pointed decision maker acting like a dictator with limited power or a military commander.
- (6) Only the democratic society can make the decision process fundamentally fair to all parties including majority, minority, children, the future generations, foreigners, aliens, animals, and other objects with free wills.

Looking forward, with the further development of quantum social science, the political decision making processes should become more scientific. The democratic societies have many natural advantages in terms of optimizing the decision making processes.

5.7.2 Index of Optimal Decision Making

This global index is designed to measure the quality of political decision making processes. The measurement has three parts.

The first part is to measure the quality of decision making at the federal government for each country. The second part is to measure the quality of decision making at the local governments for each country. The third part is to measure the quality of decision making in international organizations.

5.8 Global Trends Based on Principle of Individual Rights and Fiduciary Duty

The principle of individual rights and fiduciary duty is about personal relationships in the political equilibrium state. The principle of individual rights says that there are a set of fundamental individual rights should be not violated by different levels of governments. The principle of fiduciary duty says that the collective decision makers

must put interests of all the people whom they are representing before their own personal interests. In case of conflicts of interests, the conflicts should be resolved in a fair and transparent manner.

5.81 Global Trend toward Individual Rights and Fiduciary Duty

One of most important design principle of the US constitution is to avoid the tyranny of the majority. However, the scope should be expended. Besides the interests of minority and individual rights, the interests of children, the unborn future generations, animals, plants, other living creatures, and the general environment must be protected with the principle of fiduciary duty.

In undemocratic societies, because even the interests of the majority cannot be protected, the individual rights and the interests of minority, children, the unborn future generations, animals, plants, other living creatures, and the general environment cannot be guaranteed. Therefore, the global trend toward the individual rights and fiduciary duty is closely related with the trend of constitutional democracy.

In today's many democratic societies, the individual rights and the rights of minority are well recognized and protected. However, the interests of children, the unborn future generations, animals, plants, other living creatures, and the general environment are often ignored or even abused. There are several political movements to address the outstanding issues.

The fiscal conservative movement is a political movement to take the fiscal responsibility, reduce government deficit spending, and achieve the overall balance budgets. However, today few people recognize that the root cause of the running away government budget deficits is the common-shared government debts by different generations. In essence, current voters are taking financial advantage of their children and the unborn future generations. If the current voters are personally and legally held responsible for the current government budget short falls, there will be no budget deficit problems forever.

The animal right movement is a social movement to provide constitutional rights and legal protections to nonhuman animals. Nearly all animals have lived on the planet long before the dawn of the humanity. They have natural rights to live peacefully with the humanity. However, recent centuries have witnessed one of the biggest extinction events in the history of the planet.

The environment protection movement is well known. For a long time in the future, the humanity has only one planet to live on. However, in recent decades, the environment degradation is alarming. Many environmental issues are global in nature. For example, the Pacific Ocean is shared by dozens of countries. Right now, there is no international law whatsoever to limit the dumping wastes into the Pacific Ocean. Many rivers to the Pacific Ocean in developing countries are extremely polluted. Many global environmental issues demand a working democratic world government.

As the world becomes more globalized, the issue how to treat the foreigners properly becomes more urgent. In the US, there are tens of millions of illegal immigrants who have become important parts of the American society.

Looking forwards, the global trend toward the individual rights and fiduciary duty is unmistakable. The undemocratic societies should restore the rule of the majority

through the constitutional democracy. The democratic societies have long a way to long go to protect the individual rights, the interests of minority, children, the unborn future generations, foreigners, animals, plants, other living creatures, and the general environment. A democratic world government is essential to address many global environment challenges.

5.8.2 Index of Individual Rights and Fiduciary Duty

This global index is designed to measure the protection of individual rights and degree of fiduciary duty of the political decision making processes. The measurement has three parts.

The first part is to measure to protect the individual rights, the interests of minority, children, the unborn future generations, foreigners, animals, plants, other living creatures, and the general environment for each country. The second part is to measure the legal framework of protection individual rights and the fiduciary duty requirement of the decision makers at the different levels of governments for each country. The third part is to measure the protection individual rights and the fiduciary duty requirement of the decision makers in international organizations.

5.9 Global Trends Based on Principle of No Scientific Ultimate Purpose

The principle of no scientific ultimate purpose has not been very well understood. That is why the humanity has witnessed the rise of communism, fascism, Islamism, and different forms of nationalism in the last 100 years. Because there is no scientific ultimate purpose can be established for a human society, many politicians want to fill the huge void with their own misleading political philosophies. The results have been one political disaster after another in the last 100 years.

5.9.1 Movements of Communism and Economic Equality

The movement of communism has a well-defined ultimate purpose of establishing the communist classless society in the world with the economic equality according to Marxism principles.

The leaders of the movements of communism in many countries took the most violent approaches in order to achieve their political goals. In Cambodia, a genocide carried out by the Communist Khmer Rouge regime lead by Pol Pot murdered about 25% of the total population. The communism movements to achieve the economic equality instead of the political equality in the 20th century have claimed more than 100 million victims around the world [14].

Today, few people and countries believe in the communism. However, the movement of the economic equality is alive and well all over the world. For example, Venezuela is one of the richest oil producing countries in the world. Yet the political movement of the economic equality has created the bread lines with many miles long. In the west, the popularity of the book “Capital in the 21st Century” by Thomas Piketty has been one of the biggest events in the field of social science in recent decades.

5.9.2 Movements of Fascism

The movement of fascism also has a well-defined ultimate purpose of establishing the national and racial superiority in the world according to the fascist ideology.

One of the central claims of the fascist ideology is that the stronger nations have the right to expand their territory at the expense of the weaker states. The result was the outbreak of the World War II. The goal of achieving Nordic race supremacy by Nazi Germany led to the Holocaust, one of the worst genocides in the history.

Today fascism is no longer popular. However, the nationalisms to achieve the national supremacy by any means are alive and well in many countries.

5.9.3 Movements of Islamism

The movement of Islamism has a well-defined ultimate goal of establishing the Islamic rule of the world with the Sharia laws.

The movement of Islamism has become the major challenge to the current world order. The brutality of the movement Islamism as shown by ISIS and Taliban in Afghanistan could be matched only by the communists and fascists.

Because the root of cause of Islamism is a misleading ideology, the battles against the Islamism must be won by the ideological wars. Just like any other religions, Islam must be confined within the personal space. To impose any religion on other people is a fundamental violation of the individual rights.

5.9.4 Movements of Nationalism

The movements of nationalism are popular in many big countries like Iran, Russian, China, US, and India. Many smaller countries are not immune to the disease either. The movements of nationalism have well-defined goals of national supremacy.

Today's world order is rooted in the military strengths of the world major powers. With the rapid advances of economies, technologies, and especially military technologies, the current world order and the world peace are very fluid and fragile. Many countries are preparing for the World War III by investing heavily in the nuclear weapons, other weapons of massive destruction, and the long range delivery systems.

The ultimate solution to avoid another worldwide disaster in the future is the world permanent peace. While the New York and New Jersey State has territory dispute over the Ellis Island, there was no war between the New York and New Jersey because the US has almost achieved the national permanent peace with expectation that all conflicts of free wills within the national border will be settled in a peaceful manner.

5.9.5 Index of No Scientific Ultimate Purpose

This global index is designed to measure the acceptance of the principle of no scientific ultimate purpose. The measurement has three parts.

The first part is to measure to the acceptance of the principle of no scientific ultimate purpose at the individual level. The second part is to measure the acceptance of the principle of no scientific ultimate purpose by the governments and political leaders.

The third part is to measure the acceptance of the principle of no scientific ultimate purpose of the world by international organizations.

5.10 Global Trends Based on Principle of No Scientific Value System

The value system is needed for make most choices. Because there is no scientific value system, there is more than a way to make a choice. The principle of no scientific value system leads to the diversity of human behavior and the cultural pluralism.

5.10.1 Global Trend toward Cultural Pluralism

In the political equilibrium state, many social problems have the equilibrium solutions. For example, the government budget problem is an equilibrium solution that each age cohort of voters is responsible for their shares of government surplus and deficits. While people do not have to choose the equilibrium solution, there is an equilibrium probability distribution around the dominant equilibrium solution. In the political equilibrium state, there is no preferred value system by science. Therefore, one fundamental feature of the political equilibrium state is the diversity of human behavior and the cultural pluralism.

Today in democratic countries like the US, the human behavior diversity and cultural pluralism are evident. For example, the Amish people were allowed to keep their own life style since early 18th century in the Pennsylvania Dutch Country. In the US, as long as an activity is not forbidden by laws, the activity can be pursued by citizens. In undemocratic countries, the degree of the diversity of human behavior is a matter of government policy. A totalitarian government tends to promote only certain types of the value systems.

Looking forward, the global trend is certainly toward the cultural pluralism in the background of the globalizations. In the political equilibrium state, there is no official value system or a dominant culture. Japanese would keep their culture identities, and the Americans would keep their sports culture and Christian traditions. It is important to emphasize that the political equilibrium state does not lead to one dominant culture.

5.10.2 Index of Human Behavior Diversity and Cultural Pluralism

This global index is designed to measure the human behavior diversity and cultural pluralism of a society. The measurement has three parts.

The first part is to measure to the human behavior diversity and cultural pluralism at the individual level. The second part is to measure the human behavior diversity and cultural pluralism supported by the government and political leaders for each country. The third part is to measure the human behavior diversity and cultural pluralism supported by the world by international organizations.

5.11 Global Trends Based on Principle of Separation of Church and State

All major religions offer their own version of life ultimate purpose, value systems, and moralities. If there is an official religion established, there will be an official version of life ultimate purpose, value systems, and moralities. While the principle of separation of church and state is a widely accepted political principle in the US, the degree of separation in other countries varies greatly from Iran to Denmark.

The relationship between the church and state could not be better said than Thomas Jefferson, “Believing with you that religion is a matter which lies solely between Man & his God, that he owes account to none other for his faith or his worship, that the legitimate powers of government reach actions only, & not opinions, I contemplate with sovereign reverence that act of the whole American people which declared that their legislature should 'make no law respecting an establishment of religion, or prohibiting the free exercise thereof,' thus building a wall of separation between Church and State.”

5.11.1 Global Trend toward Separation of Church and State

In the world history, the politics and religions have been always closely intertwined.

In undemocratic societies, the organized religion is a powerful tool for rulers to control the subjects. The Ten Commandments certainly carried far more weights in people's mind for thousands of years by the assertion in the Bible that “And the Lord said unto Moses, Come up to me into the mount, and be there: and I will give thee tablets of stone, and a law, and commandments which I have written; that thou mayest teach them.” In Europe, since the Christianity was made as the state church of the Roman Empire, the mixing of the state and church has been a way of life ever since. In Islamic countries, the Islam religion has dictated very detailed laws for everyday life. In ancient China, the emperors called themselves as “Son of Heaven” in order to claim to have the mandates from the heaven to rule over China.

In democratic societies, because the individual freedom of religion is a widely respected and accepted democratic principle, establishing official religions might not interfere personal believes. However, the possibility of prosecuting and discrimination of non-believers and other minority religions are always there.

Today, the degree of separation of the church and state changes greatly from country to country. Iran is an Islamic republic with the unelected mullahs holding significant powers under a theocratic constitution. China is officially a communist atheist country and the communist party members are not allowed to join any religion. The UK has the official Church of England. Before the changes in the Succession of the Crown Act 2013, the monarch of England could not be married to a Catholic. In Australia, there is no official religion or religion test for any public office in the Constitution of Australia.

Looking forward, while the political equilibrium state encourages the religious pluralism, there should be a wall separating the church and state so that the different value systems, worldviews, and moralities also have their chances to influence the functioning of the governments.

5.11.2 Index of Separation of Church and State

This global index is designed to measure the degree of the separation of church and state in a society. The measurement has three parts.

The first part is to measure to the degree of the separation of church and state at the individual level. The second part is to measure the government legal structure supporting the separation of the church and state for each country. The third part is to measure the degree of the separation of church and state at international organizations.

5.12 Global Trends Based on Principle of Fairness

The fairness question is one of most important questions for legal, political, and economic matters in a society. It is also one of the most contentious issues in a society because most people have strong senses of fair and unfairness.

5.12.1 Global Trend toward Fairness

Since the start of the modern Olympic Games in 1896, the summer and winter Olympic Games every four years have been the most watched show cases of what should be considered as fair games in the world.

The sufficient and necessary conditions of the sports games to be fair are both the rules of the games and the process of running the actual games must be fair. Obviously, because the outcome would be very different for different players, whether the game is fair or not cannot be judged based on the outcomes.

In democratic societies, the fundamental fairness of the games of politics is guaranteed by the political equality. If everyone has the equal political power, the constitution and laws would be ultimately fair if every citizen's interests and opinions are fully incorporated. The fundamental fairness of the legal processes is guaranteed by the laws and impartial judiciary systems. The fundamental fairness of the economics is guaranteed by the laws and rules and the processes of running the actual economy. Therefore, the fairness of a society is very similar with the Olympic Games. The most important cornerstone of the fairness in a democratic society is the political equality. With the political equality, any systematic unfairness could be eliminated through political and legal processes.

In undemocratic societies, there is no political equality. With the concentration of powers on a few people close to the rulers and most citizens are out of the political decision making processes, this is very difficult to achieve the true fairness.

Therefore, the global trend toward the fairness should be very closely related with the trend of the political equality. Because of the lack of the political equality, the structure of the United Nations is fundamentally unfair. In the long run, the United Nations should be replaced by a democratic world government.

5.12.2 Index of Fairness

This global fairness index is designed to measure the degree of fairness in a society. The measurement has three parts.

The first part is to measure to the degree of fairness at the individual level. The second part is to measure the government legal structure supporting the political, legal

and economic fairness for each country. The third part is to measure the degree of fairness at international organizations.

5.13 Global Trends Based on Principle of Maximizing Wealth

The global trends of economic development are self-evident in virtually all nations. People and nations are generally getting richer. While there are still great potentials of further economic gains in the world, the exponential economic growth cannot last forever. The world economy is going to hit the ecologic, environmental, farm land, exhaustion of fossil fuels, free energy, and waste heat dissipation limits [15].

5.13.1 Global trend toward Economic Development

Because the global economy is far from any hard limit, the exponential economic growth should continue in next several centuries. The following is some trends associated with the overall global economic developments.

The trend of continuing catch up of developing countries will continue. With the economic globalization, the developing countries are rapidly catching up with the developed world. The economic development of developed countries needs new innovations to drive the productivity gains, while the developing countries could just copy the technologies, rules, and organizations. As long as the developing countries grow at a faster rate than the developed countries, it is simply mathematics that the developing countries will eventually catch up the developed countries just like Japan, South Korea, and Ireland. However, many developing countries suffer from weak political systems like lack of the rule of laws.

The trend of the world population growth will continue in the foreseeable future. One of the key drivers of the world economic growth is simply the growth of world population. At the current rate of the world population growth, the world population would be about 700 billion in just 400 years. Since Thomas Malthus, the maximum capacity of our planet has been a hotly debated question.

The trend of science and technology advances and the trend of globalization of the world economy have been highly visible in recent centuries. We will discuss further in next few sections.

Since the dawn of the humanity, the maximization of wealth has been one of key humanity goals. The agriculture revolution lifted the population and economic growth rates to a new level. The industrial revolution pushed the population and economic growth rate even much higher. It is too early to tell where the information revolution will lead us. It is no doubt that we are going to hit various limits of the economic growth in the next few centuries.

5.13.2 Index of Economic Development

The global economic development index is very well developed. However, the traditional GDP measures have many short-comings. In quantum economics, according to the fundamental equation of economics [8] in quantum economics, the better measurement of the economic well beings is simply the wealth or the value of net assets,

and the GDP will be an important secondary economic indicator. When we need to know someone's economic wellbeing, the first question is always the financial wealth and annual personal income is secondary. When the humanity is facing the various limits of the economic growth, the divergence of these two measures becomes more obvious. For example, if the humanity would decide to switch from burning fossil energy into the solar energy in next 10 years, it could generate big boosts to the world GDP for a decade. Yet the global wealth might not increase that much because the potentials of providing final products and services of the world economy do not change with the switch of the energy source.

5.14 Global Trends Based on Principle of Human Dignity

The economic inequality has been the talk of the town ever since Jesus said, "Again I tell you, it is easier for a camel to go through the eye of a needle than for someone who is rich to enter the kingdom of God."

Despite the long debates lasting thousands of years, few people actually know that the fundamental cause of the economic inequality is the voluntary exchange and the fundamental quantum uncertainty in the future.

The principle of human dignity is for governments to provide social safety nets for less fortunate citizens in order to maintain the human dignity. The right amount of social welfare assistance should be decided through political processes by the balance of the principle of maintaining human dignity and the principle of maximization of wealth.

5.14.1 Global Trend toward Human Dignity

The Global trend toward providing some social welfare to maintain the human dignity has been with us for thousands of years. In undemocratic societies, some assistance to the poor not only gaining the supports of the poor people but also stabilizing the societies in a peaceful time by projecting the positive public images. However, in more stressful environment like wars and famines, the social welfare could become an expensive burden and any cut back of entitlement programs would magnify the resentment of the poor. In democratic societies, the rich and poor gap and economic inequality are always central political issues.

The idea that governments must provide some social safety nets for less fortunate citizens is well recognized by most countries today. The debate of economic inequality is really centered on the exact level and structure of social welfare spending. Because the economic inequality debate involves the economic interests of every citizen, the economic inequality is an explosive political issue that many politicians and social scientists want to exploit the issue for their own benefits. If you are fighting the rich people in the name of the poor, you look like the legend Robin Hoods.

Looking forward, the key question for quantum politics is whether there exists an equilibrium level and structure of social welfare spending.

The question remains largely unsolved. However, the resource rich countries like Norway and Canada should certainly have higher levels of social welfare spending than the resource poor countries like Japan.

5.14.2 Index of Economic Inequality and Human Dignity

This global index is designed to measure the degree of economic inequality and human dignity in a society. The measurement has three parts.

The first part is to measure to the degree of economic inequality and human dignity at the individual level. The second part is to measure the government legal structure and programs dealing with the economic inequality and human dignity for each country. The third part is to measure the degree of economic inequality and human dignity at international level like assistance to the poor countries.

5.15 Global Trends Based on Principle of Limitation of Science and Technology

The most astonishing development in the world history has been the advances of the science and technology. While the technology advances can traced back to the stone tools, the modern science is truly established only after the publication of Newton's Principia.

It is important to emphasize that the science and technology have their own fundamental limits. Although we have few idea what that ultimate limits will be, eventually most interesting science and technology will be discovered.

5.15.1 Global Trend toward Limitation of Science and Technology

The global trend of the science and technology advance is well documented in the world history books. We are not going to repeat here.

Looking forward, the interesting question is what will be the fundamental limit of science. There have been visibly slowing down of new physics discoveries since the creation of quantum mechanics. For example, with exception of physics laws of social science, we have not discovered a single fundamental physics law in last 80 years. While there are many important discoveries, the basic framework of modern physics remains unchanged since the creation of quantum mechanics. The standard model is just a completion of applying quantum theory to study the fundamental particles. After the standard model, there is no single experiment that contradicts with the standard model prediction. The physics laws of social science are just results of applying quantum theory to study the human society. Of course, there are still many open questions in physics like the completion of applying quantum theory on gravity. It seems that we are writing the final chapters of fundamental physics theories. The applications of fundamental physics theories will continue in the foreseeable future.

The more elusive and intractable question is what will be the fundamental limits of technology. The fundamental limits of technology is closely associated with the fundamental limits of economic grow. As we discussed in an earlier paper [6], there are certainly fundamental limits to the exponential growth of the economy. The natural logic consequence is that there will be fundamental limits of technology.

For example, if the thermodynamic waste heat limit is the fundamental limit of the world economy, the fundamental limits of technology will be defined as most energy efficient methods of producing products and services for the humanity. From laws of

physics, there are well-defined fundamental physics limits for the highest energy efficiency for all technologies.

5.15.2 Index of Science and Technology Advances

This index is to measure the science and technology advances. Because it is very hard to quantify the relative importance of the new developments of science and technology, it is an unsolved question how to design an indexing methodology to measure the true advances of science and technology. The index should have three parts.

The first part is to measure the science and technology education and usage at the individual and company level. The second part is to measure the new advances for science and technology research for each country. The third part is to measure the new advances for science and technology research without national border.

5.16 Global Trends Based on Principle of Globalization

In recent decades, the globalization processes have been the most significant world events. The globalization trend should continue in all areas of human activities in the foreseeable future.

Since the dawn of the humanity, people have been global citizens recognizing no national borders for the most part. In recent thousands of years since the agriculture, people have developed the political concept of individual countries. The concept of country is going to a temporary phenomenon. Hopefully in not far into the future, the national borders will disappear, and the concept of country will be downgraded into just a name for a regional.

5.16.1 Trends towards Globalization of Information

In last two decades, the internet has helped the globalization of information. If it was not limited by the national borders and local politics, almost anyone on this planet with a computer or smart phone could access most information on the internet for free. This is a monumental achievement in the world history.

Because the information is the most important input of human choices, the globalization of information will have profound impacts on every aspect of human activities.

5.16.2 Trends towards Permanent World Peace

In last 100 years, while there are many countries that have almost achieved the national permanent peace within their border, the international front toward the permanent world peace has not been obvious.

What is highly visible on the military front is the continuation of rapid development of new military technologies including new weapons of massive destruction. With the diffusions of knowledge of developing the dangerous weapons through the internet, the need of establishing a democratic world government to stop the developing these dangerous weapons becomes ever more urgent.

However, with the advances of the internet, the global sentiment toward violence and wars are shifting rapidly. Most people on the planet are starting to accept the principle of nonviolence to resolve the conflicts of free wills.

5.16.3 Trends of Economic Globalization

Applying the Law of Equilibrium on the global scale, it is no doubt that world economy will eventually reach the most efficient equilibrium state through international trades.

Many markets are increasing becoming global markets in recent decades. The commodity markets, such as oil and copper, have already been globalized and tightly integrated. After China opened its door to the global trade in 1978, the global manufacturing sector has also been increasingly globalized. In the last few years, we have witnessed the rise of India in the computer software and service industry. With the integration of global economy and the flows of investment on the global scale, the world financial markets are also starting to integrate. For example, increasingly more stocks of foreign companies are listed in New York Stock Exchange and NASDAQ.

Even at this early stage of globalization, we start to witness winners and losers at the national-level in the globalization process. It is hard to believe that Ireland today enjoys the second highest income after Luxemburg largely because of forces of globalization. Ireland's pro-business policies, simple tax codes, and English-speaking population have attracted strong flows of oversea business and investments. In sharp contrast, Southern European countries like Greece and Spain have been suffering high unemployment rates, unbearable social welfare burdens, and aging population. In a global economy, the competitions at the national-level are centered on taxes and economic policies, welfare systems, natural resources, educational-level of the labor force, work ethics, and political systems.

The continuing globalization has made many people angry and confused. Is there a way to stop or even reverse the globalization processes? No. According to the Law of Equilibrium, if people cannot prevent themselves from aging, people cannot stop or reverse the globalization processes. Quantum uncertainties, which cause people to age, are driving the global economics to integrate. However, the international politics could slow or fasten the globalization processes. In this book, we say people on this planet are brothers and sisters. What is wrong with trading with our own brothers and sisters? Ultimately, globalization of economy will be the economic foundation of permanent world peace. For the human race as a whole, the globalization of economy should use the global resources more efficiently, and should force different nations to adopt the best practices in terms of economic and welfare policies.

On the other hand, because of no world government to ensure global minimum environmental, legal, labor, tax, and other basic standards, some companies are taking advantages of loose regulations in developing countries to create unfair competitions, illegal activities, or cause irreversible damages to the environment and people.

To summarize, the Law of Equilibrium is driving the global economy toward the most efficient global economic equilibrium state. The globalization of economy is consistent with the long-term trend of the global political equilibrium state of permanent world peace.

5.16.4 Other Globalization Trends

Since the great recession, there is a growing global political coordination through meetings of world politics leaders. Today, there are many challenges are global in nature. While many markets are globalized, there are no international legal frameworks to manage the global markets. The many environment challenges are global. Who is responsible and who is going to pay for saving the environment? Problems are well known. Yet the international solutions are hard to come by. Many armed conflicts like ISIS and Syria involves many countries. The internet is truly global recognizing no national boundaries. How to punish malicious hackers and attackers? In recent decades, many infection diseases like Ebola and bird flu are becoming global.

To deal with these international challenges, the simple solution is to have a democratic world government. However, the idea of the world government turns off many people partially because there is so much mistrust among the major world powers like the US, China, Russia, India, European Union, Japan, and Iran. Instead of working together to forming a democratic government, these major world powers are investing heavily on military technologies and preparing the World War III.

The first step toward a democratic world government could be a scientific theory of the permanent world peace. A physics theory of the permanent world peace [6] might be able to persuade global citizens to move toward achieving the national permanent peace through the constitutional democracy in their own countries. The US, as the oldest mature democratic countries, should set good examples by fixing many fundamental design flaws of the US constitution [10]. With the epidemic gun violence and the running away budget deficit plus unfunded liabilities in the US, it is difficult to convince global citizens that the constitutional democracy like the US is the future for their own countries and the world.

5.16.5 Index of Globalization

The index of globalization is to measure the degree of the globalization in terms of global trade, internet and information openness, finance, political systems, legal systems, human resources, immigration, travel, and international cooperation. The index should have three parts.

The first part is to measure to the degree of the globalization at the individual and company level. The second part is to measure the government legal framework supporting the globalization for each country. The third part is to measure the degree of globalization supported by international organizations.

6 Concluding Remarks

We have discussed each of the 16 global mega trends. These trends dominate the world politics, economics, and social dynamics. The world changes mainly through these 16 directions. The national index methodology would be a very useful measure of the degree of the national development. Even in a mature democratic country like US, there are many things [10] to be improved in order to achieve the true political equilibrium state.

Identifying these 16 hydrodynamic modes further strengthens the argument that social science is a subfield of quantum physics just like the condensed matter physics and chemistry. The arrow-of-time phenomena in the human society and the natural world share the same identical fundamental causes of quantum indeterminacy and human choices.

7 **Reference and Notes**

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